Stories of Hope: Stroke

If **K. Michael Cooper** ever thought about giving up after his stroke Thanksgiving morning 2003, his wife, Annemieke Wiegman, wouldn't let him. He was 56 years old when the sudden loss of circulation in his brain changed the Redwood City man's life. He couldn't speak. He couldn't swallow. He couldn't move his right side. But almost from the start, Annemieke treated her husband like a man with a very important deadline.

"She kept telling me, I only had six months to get better," he said.

While other patients were wheeled to lunch, Annemieke insisted Cooper use a walker. While other families helped loved ones eat, "My wife let me struggle and make a mess." Annemieke launched a rehabilitation program, lifting her husband's unresponsive arm and leg 12 times every day.

"She did not give up on me, and I did not want to give up, "he said.

Released from rehab on Christmas Eve, Cooper continues to work on his recovery, especially his speech, still peppered with small hesitations and stutters.

While Cooper believes in working on recovery, he relishes the promise of stem cells.

"There are so many things doctors can do with stem cells that will really help," he said. "Oh yes, I'm very hopeful."

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- Read more about CIRM funding for stroke research

CURING STROKE

Stem cells at first seemed ideal replacement parts, living Legos for stroke-damaged brains. But when Gary Steinberg, director of neurosurgery at Stanford University's School of Medicine, put human stem cells into the brains of rats with induced stroke, he saw the cells didn't just turn into new neurons to swap for the damaged ones.

While about half of the cells became functioning neurons, the benefits went beyond their contribution. The stem cells seemed to respond to a suite of signals the damaged brain sent in its attempt to quell the stroke-triggered chaos. The result: reduced inflammation, increased blood supply, new growth on existing neurons and new neuronal connections. In addition, rats treated with stem cells recovered function in limbs affected by stroke.

Normally, the brain's stroke distress calls rarely summon sufficient repair. Fifteen percent of people with ischemic stroke – that is, stroke caused by blockage in an artery – die from it, and stroke caused by a burst blood vessel kills half its victims. Among the survivors of both kinds of stroke, damage can be devastating. A third can no longer care for themselves, and three-quarters lose the

ability to complete some tasks of daily living.

Steinberg hopes that cells derived from embryonic stem cells, with their ability to travel directly to damaged areas in the brain, could bring dramatic change. Stem cells implanted in rodents with stroke worked to repair damaged areas, summoned there, apparently, by signaling chemicals called chemokines. Further research showed that the stem cells emit a signaling protein called vascular endothelial growth factor. When Steinberg blocked VEGF using the cancer drug Avastin, many of the stem cell's positive effects disappeared.

Stem cells act as an efficient delivery device for VEGF and other growth factors, Steinberg said, integrating into the environment, responding to nearby signals, and releasing the growth factor only where and when needed.

Although his goal is to begin a phase 1 stroke trial with human embryonic stem cells by 2014, his group recently opened enrollment in a Phase 1 trial sponsored by the Mountain View company, SanBio, using bone-marrow derived stem cells. In this safety study, surgeons will implant cells in patients whose stroke occurred six months to a year earlier. In a previous small trial using these cells, there were no adverse effects, and some participants saw improvements in movement, memory and spatial processing.

"I believe that stem cells transplantation for stroke holds great promise," Steinberg said. "Over the next probably two decades we will see remarkable advances."
